

MISR Level 1 Alpha Products Quality Statement

June 15, 2000

This statement applies to MISR Level 1 Products generated from data acquired June 1, 2000, and beyond until such time as further improvements to MISR processing are made. These products are of Alpha quality.

An intensive data quality assessment of these Level 1 products has NOT been performed. The radiometric and geometric calibrations used to support data production contain known deficiencies. It should also be noted that new problems in the production software and surprises in the raw data stream are still being discovered. Due to all of these circumstances the Alpha products should be used with caution. They are not yet intended for use in scientific investigation.

In spite of the above cautions, the MISR Level 1 software which produced the product files is believed to be functioning nominally except where noted below. The list below highlights major known issues with the products as well as some product attributes which might be confusing.

Geometric Parameters (a.k.a GP_GMP, MIB2GEOP) (from MISR PGE7)

No problems have been found with the current release of PGE7 software. Preliminary analysis indicates that the software is meeting all of the requirements. Further analysis is planned.

The Geometric Parameters exhibit one algorithmic quirk of which users should be aware. Solar zenith and azimuth angles near the swath edge occasionally appear to jump around. This is the result of an intentional choice of algorithm whereby solar angles are computed for the mean time at which MISR cameras viewed the ground point in question. Adjacent points are not always visible to the same set of cameras. This can cause a bias in solar angle towards cameras which acquired that point.

L1B2 Terrain (a.k.a. GRP_TERRAIN_GM, MI1B2T) (from MISR PGE1)

L1B2 Ellipsoid (a.k.a. GRP_ELLIPSOID_GM, MI1B2E) (from MISR PGE1)

This portion of the list is rather long, so the sub-headings are listed for quick reference.

- [ANCILLARY GEOGRAPHIC PRODUCT \(as of September 19, 2000\)](#)
- [RADIOMETRIC CALIBRATION](#)
- [REGISTRATION](#)
- [GAPS](#)
- [SPIKES and IMAGE ECHOS](#)
- [INSTRUMENT OUT-OF-SYNC](#)
- [TERRAIN TOPOGRAPHIC OBSCURATION](#)
- [TERRAIN OCEAN FILL](#)

ANCILLARY GEOGRAPHIC PRODUCT (as of September 19, 2000)

The Ancillary Geographic Product (AGP) contains eleven fields of geographical data. For the purpose of this quality statement, the AGP data fields are categorized into following groups:

- Group A: Geographical locations corresponding to a 1.1 km resolution grid defined in the Space Oblique Mercator (SOM) map projection 1) geographic latitude, and 2) geographic longitude.
- Group B.1: Elevation data corresponding to a 1.1 km resolution grid defined in the Space Oblique Mercator (SOM) map projection: 1) point elevation, 2) average scene elevation, and 3) standard deviation of scene elevation.
- Group B.2: Regional elevations data corresponding to a 17.6 km resolution grid defined in the Space Oblique Mercator (SOM) map projection: 1) regional average scene elevation, and 2) regional standard deviation of scene elevation.
- Group C: Surface orientation data corresponding to a 1.1 km resolution grid defined in the Space Oblique Mercator (SOM) map projection: 1) average surface azimuth angle, 2) average surface zenith angle, and 3) standard deviation to the mean surface slope.
- Group D: Land/Water identification data corresponding to a 1.1 km resolution grid defined in the Space Oblique Mercator (SOM) map projection: 1) land/water identifier 2) dark water algorithm suitability mask.

The major portion of the AGP data fields are created using the following datasets as the input: 1) Digital Terrain Elevation Dataset (DTED), 2) Digital Chart of the World (DCW) Hypsography, 3) ETOPO5, and 4) World Vector Shoreline. Mostly, the AGP generated data directly reflect the quality of the inputs without degradation. However, there is a slight reduction in quality due to the processing algorithm used for some of



the data fields. The details of the algorithm underlying the creation of the AGP can be found in "Level 1 Ancillary Geographic Product ATB". The following are quality statements associated with previously defined groups of AGP data fields.

- Group A quality statement: A point-by-point map projection computation was used in order to produce latitude and longitude data for the centers of the 1.1 km resolution grid and achieved a one centimeter accuracy.
- Group B1 quality statement: The point elevation data are directly obtained from the input datasets and there is no degradation in quality. However, the specific definition of the average scene elevation and standard deviation of scene elevation required a processing step which included resampling between the input and output grid of the same resolution. This processing step caused some reduction of quality, especially in the regions with high relief. Quality information resulting from a global validation of these fields will be added in the next release of AGP dataset.
- Group B2 quality statement: Due to the low resolution of the recording grid, there is no quality degradation for the data fields in this group.
- Group C quality statement: For average surface azimuth angle and average surface zenith angle, the processing step based on the resampling caused some reduction in quality, especially in regions with high relief. Quality information resulting from a global validation of these fields will be added in the next release of AGP dataset. The standard deviation to the mean surface slope should not be considered reliable. The global validation results indicate that produced value does not match its definition as specified in the Algorithm Theoretical Basis document.
- Group D quality statement: Overall, the land/water identifiers are as accurate as the input dataset (i.e. World Vector Shoreline) used to derive these data fields. It should be noted that discrepancies exist between some of the Arctic and Antarctic continental and island shorelines as delineated in the elevation fields versus those delineated in the land/water identifier fields. This is the result of the input products chosen for data preparation, and not a computational error. The WVS is used to delineate all shorelines globally because it represents the most up-to-date delineation at the best scale map available.

RADIOMETRIC CALIBRATION

Radiances in the MISR Level 1 products are based upon release 3 of the In-flight Ancillary Radiometric Product (ARP) database. It provides our first post-launch estimate of the radiometric response of the MISR cameras. This analysis utilizes camera views of the on-board Spectralon diffuse panels, and assumes that the panels are spectrally and spatially uniform. Thus, this version removes some cosmetic artifacts of the uncalibrated imagery, such as Aa and Af camera vignetting at the extreme field edges, and eliminates faint interference fringing, which prior to this ARP update contributed spatial nonuniformity to the imagery of a few percent in the worst case.

Radiometric uncertainties in MISR imagery on the order of 5-10% can be expected based upon this version of the ARP, which does not yet make use of our on-board detector standards. Consequently, it also does not remove random errors we have observed in the calibration of one camera to another, nor in the relative response of one band to another. Improvements will follow in the next release.

A final consideration for users is that the radiance reported for an individual pixel in one of the L1B2 products is obtained by resampling to the SOM map projection. Therefore, an individual L1B2 pixel does not necessarily correspond directly to an observation made by a single camera-CCD pixel.

REGISTRATION

Georectification and coregistration of MISR Level 1 products are based on a limited geometric calibration. Coregistration errors on the order of 500 m to 2500 m between the nadir and off-nadir camera views can be expected, with the largest errors occurring at the Df and Da angles. A fully calibrated camera model, to be available by the end of July 2000, will improve the overall georectification and coregistration accuracy to a level consistent with the spatial resolution of the imagery.

GAPS

The raw MISR data contains occasional gaps. These gaps usually consist of a few lost lines. Straight lines of raw data are resampled to gentle curves in the SOM map projection. Radiances in the gap regions are filled in with pre-defined fill values. Gaps then usually look like narrow, curved, bright, horizontal stripes in the L1B2 image. There is at least one small gap in almost every swath. In rare cases, data gaps of many lines have been observed.

SPIKES and IMAGE ECHOS

L1B2 software processes a half-block at a time. If the software encounters fatal processing errors in a half-block region, then that region is skipped, and processing is attempted in the next region. The current version of the software does not adequately fill in the regions which are skipped. Therefore, whatever happens to be in computer memory gets written to the product file for that region. This behavior is often evident at the beginning of the swath where the geolocation process attempts to bootstrap itself, often taking a few regions to get running smoothly. In these skipped regions, radiance values of zero with occasional high spikes and regions of echoed image from previous regions may be visible.

INSTRUMENT OUT-OF-SYNC



Image lines acquired while the MISR instrument was out-of-sync may contain sporadic fill and/or repeats of previous lines. The resulting image contains a brief vertical smear across the swath. Normally, this phenomenon only lasts for a handful of lines. Unfortunately, all pixels below these regions may suffer from poor downtrack geolocation. Further explanation follows.

The MISR instrument tends to go out-of-sync momentarily if the data rate from the hardware exceeds the real-time flight computer's capacity to write data out. This condition can occur whenever the instrument is put into Local Mode as well as when the Aa camera exposure correction is sent. The later occurs every orbit when the Aa camera begins global mode acquisition. The resultant error is seen most often in the forward and nadir cameras near the beginning of the swath.

The stream of line times reported in the raw data has been observed to jump forward over out-of-sync regions. Often it appears as if the instrument has skipped a few time cycles and didn't output any image lines. Since geolocation is completely dependent upon the times reported, out-of-sync conditions may cause half-blocks to be skipped or severely distorted. At this time we suspect that all geolocation below out-of-sync regions may be affected by a static amount.

TERRAIN TOPOGRAPHIC OBSCURATION

The line-of-sight between an off-nadir camera and a ground point is sometimes blocked by a topographic feature, such as a mountain. In such cases, fill values are reported instead of radiances in the terrain product. Large patches of obscuration fill can be seen in the D cameras over mountainous regions.

TERRAIN OCEAN FILL

Blocks which encompass no land at all get entirely filled with ocean-fill values in the terrain product. Terrain algorithms are wasteful over ocean since height variation is negligible there. The Ellipsoid product already contains radiances for these blocks. If ocean blocks are required, blocks from the Ellipsoid product may be substituted.

